1.0
INTRODUCTION

1.1 GENERAL

Best Management Practices (BMPs) receive consideration for control of nonpoint source pollutant discharges (in this case, urban runoff) because of the favorable influence they are expected to exert on receiving water quality by reducing the mass loading of pollutants that would otherwise be carried into such waters by storm runoff. Studies conducted under the NURP program indicated detention and retention basins to be the most effective and reliable of the techniques examined for control of urban runoff pollutant loads. The principal mechanisms that influenced pollutant removals were either subsurface infiltration, or sedimentation.

A detention device installed at a specific location is necessarily of a fixed size and capacity. Storm runoff, on the other hand, is highly variable. Any installation, therefore, will exhibit variable performance characteristics, depending on the size of the storm being processed, and in general, will perform more poorly for the larger storms than for the smaller ones. When performance is influenced significantly by the storage volume available, results obtained will be modified by residual stormwater from prior events that still occupies the basin when the next event occurs. Since storm intervals are variable, this factor frequently has a significant influence on performance. For detention devices such as wet ponds, which maintain a permanent pool of water, there is a further complication to the ability to describe performance. For many storms in all basins, and for virtually all storms in large basins, the effluent displaced during a particular event represents, in fact, a volume contributed to by the runoff of some antecedent event.

The performance of any control device that treats urban runoff should therefore be characterized in such a way that the variability and intermittent nature of storm runoff is recognized and accounted for. It is also desirable that the analysis procedures used provide a basis for making reasonable projections of performance under conditions other than those tested. An obvious alternative set of conditions relates to the effect on pollutant removal of basins of different sizes; however, the important factors include performance over all storms for an area in contrast to those monitored in a test program, and performance in areas where storm patterns are different.

The methodology presented in this report is based on a probabilistic technique that accounts for the inherent variability of the situation it addresses. The analysis has a planning orientation rather than a research one, consistent with the principal focus of the NURP program. The basic objective of the analysis that has been structured is to provide a basis for establishing "first order" design specifications (size, detention time), in terms of a long-term average removal of urban runoff pollutants. A secondary objective for a useful planning tool is that it be sufficiently simple, fast, and economical to apply, so that a large number of alternative scenarios are practical to examine. The methodology presented meets both these requirements, and by comparison with actual performance data and/or projections from more elaborate simulation models, is indicated to provide sufficiently accurate performance projections for the intended purposes.

There are other analysis methods available that can accomplish the same objective. EPA's Storm Water Management Model (SWMM), and the Storage, Treatment, Overflow Runoff Model (STORM) are both well documented simulation techniques that have seen extensive use. They have, in fact, been used in some of the validation tests of the probabilistic method, where adequate performance data were not available for comparison. Since these simulators can avoid several of the simplifying assumptions of the probabilistic approach, the estimates they provide are likely to be somewhat more accurate projections. The only real restriction to their use is a practical one. The user must have convenient access to a computer on which the program is installed, and preferably experience in the use of the programs.

Although other approaches are available to a user, the methodology presented in this report is believed to have several advantages. It permits an analysis to be performed without the need for access to a computer. Analyses are simple enough to perform that there is no practical constraint to examining a large number of alternative conditions of interest. These factors and the organization of the computations (input requirements and output format) emphasize the utility for planning purposes.

1.2 ORGANIZATION OF REPORT

Section 2 describes the probabilistic methodology and discusses the rationale and use of the performance graphs, and the equations on which they are based.

Section 3 addresses recharge devices and presents a description of the methodology, an example problem, validation tests, and a discussion of the application of the methodology and some limitations and practical considerations.

Section 4 addresses wet pond detention basins using the same format.

Section 5 presents results of a series of analyses using the methodology, illustrating differences in size/performance relationships as influenced by regional differences in rainfall characteristics. These generalized results may be used as an initial screening indication, to be further refined by use of specific local parameters in the analysis.

An Appendix provides information to assist the user in estimating values for parameters used in the methodology.